

Brief Instructions
NORDAC SK 1000E

Servo Controller
SK 1000E-101-340-A ... SK 1000E-102-340-A

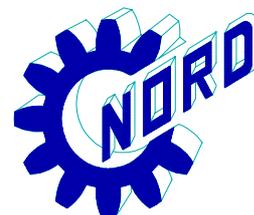


These concise instructions indicate the basic data of the NORD servo controller and describe the essential procedures with which a control configuration is set up. For any additional information you may require please refer to the unit's **hardware description** and to the descriptions of the **operating software** and of the **bus systems** which are stored as pdf. files on the NORD SERV CD coming with every new unit. The same information can always be obtained via the NORD SERV help function as well. Documentation on the servo controller further includes a detailed **cable specification** and an **applications** brochure specifically illustrating connection options, cubicle mounting, and the use of various extension modules.

BU 1000 GB

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Getriebebau NORD
GmbH & Co. KG



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Instructions for the safety and use of inverters feeding drives

(in accordance with: 73/23/EEG low-voltage directive)

1. General

Depending on their type of enclosure, driving current converters may have live, bare, in some cases even moving or rotating parts as well as hot surfaces during operation.

Inadmissibly removing the required covers, improper use, incorrect installation or handling can be dangerous and may lead to serious damage to persons or property.

See the documentation for more detailed information.

Any transport, installation, starting-up or maintenance work shall be performed **by properly qualified, skilled and competent personnel** (IEC 364 or CENELEC HD 384 respectively or DIN VDE 0100 and IEC 664 or DIN VDE 0110 and national accident prevention regulations to be observed).

Qualified, skilled personnel as mentioned in these basic safety instructions is understood to refer to persons who are familiar with the installation, assembly, setting-up, and operation of the product and who have the qualifications required for the job of which they are in charge.

2. Intended use

Driving current converters are components designed to be integrated into electrical installations or machinery.

If the converters are installed in machines, they must not be put into operation (in other words, operation as intended by the manufacturer must not begin) until it has been established that the machine in question actually meets the requirements mentioned in the EC directive 89/392/EEC (Directive For Machines); EN 60204 is to be observed.

The device must not be put into operation (i.e. operation as intended by the manufacturer must not be started) unless the stipulations of the EMC directive (89/336/EEC) are fulfilled.

Driving current converters meet the requirements stated in the low-voltage directive 73/23/EEC. Likewise the accorded standards of the series prEN 50178/DIN VDE 0160 in conjunction with EN 60439-1/ VDE 0660 Part 500 and EN 60146/ VDE 0558 are applied to the driving current converters.

Refer to the rating plate and the documentation for details on technical data and connecting requirements and do not fail to observe them and to follow instructions.

3. Transport, storage

Follow the instructions for transport, storage, and proper handling.

4. Installation

The devices must be installed and cooled as directed in the relevant documentation.

The driving current converters must be protected against inadmissible stress. It is of particular importance that no components are bent and/or insulation distances changed during transport and handling. Do not touch electronic components and contacts.

Driving current converters contain electrostatically sensitive components which are easily damaged through improper handling. Electrical components must not be damaged or destroyed mechanically (potential health risks!).

5. Electrical connection

Follow the applicable national accident prevention rules (e.g. VBG 4) when working on driving current converters while they are live.

Electrical installation is to be performed in accordance with applicable rules and regulations (e.g. regarding conductor cross sections, fusing, PE connection). Apart from these, more instructions may be mentioned in the documentation.

Recommendations for meeting EMC standards in installation – for instance with regard to screening, earthing, filter arrangement and the routing of lines – are found in the converter documentation. CE-marked driving current converters are always subject to such instructions as well. It is the responsibility of the machine or plant manufacturer to ensure that the limit values stipulated by EMC legislation are duly met.

6. Operation

It may be necessary to provide facilities in which driving current converters are installed with additional monitoring and protecting devices to satisfy the applicable safety regulations, e.g. the law on technical work materials, accident prevention regulations etc. Modifications of the driving current converters by means of the operating software are allowed.

Do not touch live parts of the device or power terminals right after the converter has been disconnected from the supply voltage as capacitors may still be charged. The information plates on the driving current converter will give you precise details on the subject.

Keep all covers closed during operation.

7. Service and maintenance

As described in the manufacturer's documentation.

Do keep these Safety Instructions for future reference!

Special safety and operating instructions affecting the SK 1000E



NORDAC SK 1000E servo controllers are operational equipment for use in industrial power plant. That is why touching them may cause, due to the voltages at which they are operated, serious injuries or even death.

- The device continues to be dangerously live for up to 5 minutes after its disconnection from the mains. Accordingly the device must not be opened or either the covers or the control panel be detached until 5 minutes after it has been disconnected from supply. Reattach all covers before switching the mains voltage on again.
- Even when the motor has stopped (e.g. following blocking of the enable signal, jamming of the drive, or a short circuit of the output terminals), the supply terminals, the motor terminals, and the braking resistor terminals can be dangerously live. Even if the motor is not running it can by no means be assumed that it is also electrically isolated from the mains.
- **Caution**, parts of the control board and especially the connecting plug for flash, JTAG, and software programming carry a dangerous amount of voltage as well. If the DSP is programmed via an JTAG connector, an opto-isolator must be used which is available specifically for this purpose. No mains potential is applied to the external control terminals however. The JTAG interface is a programming interface for DSP and controllers standardized among manufacturers for which several companies e.g. Spectrum Digital propose suitable connection adapters. The internal safety cover protecting it must not be removed.
- **Caution**, certain setting configurations may cause the inverter to start up automatically when it is connected to the mains.
- The printed circuit boards carry highly sensitive MOS semiconductor components for which static electricity can be particularly harmful. That is why you should avoid touching the conductive tracks or electronic components with your hands or with metallic objects. When connecting the cables, use insulated screwdrivers to manipulate the screws of the terminals strips.
- The servo controllers are intended for permanent connection only and must not be operated without having been effectively earthed as stipulated by the local regulations for high leakage currents (> 3.5 mA). The German VDE standard 0160 demands that either a second earth conductor be laid or that the earth conductor cross section be 10 mm² minimum.
- If according to local regulations the leakage current must by no means include any amount of a d.c. component, conventional **fault-current circuit breakers** alone will not afford sufficient protection where servo controllers are concerned. The construction of standard fault-current circuit breakers is supposed to meet the new VDE 0664 requirements.
- NORDAC SK 1000E servo controllers are maintenance-free provided that they are operated according to instructions. In a dusty environment the cooling surfaces must be cleaned with compressed air at regular intervals.

CAUTION! DANGER!

The power section may still be live for up to 5 minutes after disconnection from the mains. Controller terminals, motor supply cables, and motor terminals may be live as well! Touching exposed or unconnected terminals, cables, or parts of the device may lead to serious injuries or even death!

| | |
|--|--|
| | <h2 style="margin: 0;">CAUTION</h2> <ul style="list-style-type: none"> • Ensure that neither children nor the general public will have access to the device or a chance to manipulate it! • The device must not be used for any purpose other than the one intended by the manufacturer. Unauthorized modifications and the use of replacement parts and attachments which are not sold or recommended by the manufacturer may cause fire, electric shock and injuries. • Keep these Operating Instructions where they will be accessible to any person involved in using the device, or give them to him/her on your own accord! |
|--|--|

European EMC Directive

If the installation instructions specified in the present manual are duly observed, the NORDAC SK 1000E will meet all of the EMC requirements stipulated in the said directive, conforming at the same time to the EN61800-3 EMC product standard for motor-driven systems.



If sold in North America, UL and CSA licenses

"Suitable for operation on a power supply system not exceeding either a 460-volt three-phase current, or a symmetrical short-circuit current of 5000 A, and provided that "J" class fuses are used for protection as specified."

Applications for approval filed



1 General

1.1 NORDAC SK 1000E servo controllers

A number of specifications is being prepared these days which will complement the present instructions. These will be continuously adjusted and updated as various product features are further developed and enhanced. Rather than being published as they come, the descriptions of such new features are accumulated and then incorporated into the existing text from time to time.

1.2 Type and equipment options

| Type option | Description | Data |
|----------------|--|---|
| R for resolver | Feedback = Resolver | 12-bit resolution |
| E for encoder | Feedback = Incremental encoder We recommend the use of an extra Hall component | Upwards of a 500-increment resolution, any graduation can be selected |
| RS for absolut | Resolver with optional 1Mbaud CAN and absolute value encoder, no stepping motor interface | For resolver and absolut |
| ES for absolut | Encoder with optional 1Mbaud CAN and absolute value encoder, no stepping motor interface | For encoder and / or absolut |
| RT | Resolver with optional technical control functions | See NORD application brochure |
| ET | Encoder with optional technical control functions | See NORD application brochure |
| RST | Resolver with optional 1Mbaud-CAN and absolute value encoder, no stepping motor interface, with optional technical functions | |
| EST | Encoder with optional 1Mbaud-CAN and absolute value encoder, no stepping motor interface, with optional technical functions | |

All servo controller types are capable of operating both synchronous and asynchronous motors. Configuration should include loading the data record of the motor being used from the database.

1.3 Delivery

When the device is delivered, it should be examined for transport damage **right away**. Inspect the packaging first and, after unpacking the device, check whether it has been deformed or whether there are loose parts. The carrier should be notified of any damage that may have occurred during or as a result of transport immediately. Make sure too that the full extent of the damage is assessed.

Important! Proceed in the same way even if the packaging is intact.

To find out whether the firmware version (inquire under NORD SERV: device/controller info) and the version of the NORD SERV operating software (displayed in the top lefthand corner) are compatible, check the place before the decimal point in either version designation. If it is the same in both versions, they are compatible.

Available on request resolver- **or** encoder-type IP 20 panel-mounting unit
1MbaudCAN and SSI input **or** 500KbaudCAN and stepping motor input with
or without special technical control functions

Standard design integrated braking chopper
integrated line filter ensuring compliance with limit curve A as per EN 55011
integrated shield supporting angle
CAN bus, RS232/RS485, 2nd resolver or encoder input or output
PLC plus 6 inputs and 6 outputs, each of them programmable
+/-10V input, reference and limit switch inputs
motor temperature and motor holding (reversal prevention) brake logic
internal logic and internal voltage supply
PC operating software with integrated online help (NORD SERV)
operating instructions

Accessories available braking resistors IP 20 for underside installation, with different capacities
line filters ensuring compliance with limit curve B as per EN 55011, IP 20, to
be fitted from below
line choke, IP 00
RS 232 → RS 485 interface converter
cable set

1.4 Controller characteristics and features

- will operate synchronous and asynchronous motors
- highly dynamic response, motors can be operated with an electrical, mechanical time constant as low as 0.5ms
- full torque available at standstill
- sinusoidal commutation
- entirely digital control concept
- integrated line filter A
- integrated braking chopper with external braking resistor
- the control process sampling time is 50µs for all types of control – torque, speed, and position
- ramp generator / speed profile generator
- when the position control mode is on, settings of positions, travelling speeds, and ramps can be changed while the equipment is moving
- stepping motor interface allowing for an input frequency of up to 5MHz
- special technical functions such as electronic adjustment from one speed to another between different motors, control of flying saw, winding machines
- please note -> request the Applications brochure NORD has prepared on the subject
- incremental encoder, resolver, or absolute value encoder (SSI)
- incremental encoder emulation output
- CAN field bus (up to 1 Mbps), RS 232 and RS 485 (up to 56000 bps)
- CAN field bus with CANopen protocol DS301V4.01&DS402V1.1, an EDS configuration file is supplied with each new device
- variable PDO mapping
- ±10V analogue setpoint interface
- 9 inputs to be assigned by the user as required
- 6 outputs, short-circuit-proof, to be assigned by the user as required
- 1 user-programmable relay, e.g. to control an integrated holding brake
- integrated stored-program controller PLC with an input assistant enabling highly convenient intuitive operation
- will execute logic and arithmetic operations with variables and constants
- reference switch logic is integrated
- limit switch monitoring function is integrated
- with an operating software including database and oscilloscope functions, configuration is quickly and conveniently carried out
- the devices can be mounted side by side without any extra space in between
- variability of displacement commands which can be interrupted and changed any time
- ambient temperatures up to 40°C are allowed
- suitable for high motor speeds (depending on the encoder type)

2 Installation and connection

2.1 Mounting requirements

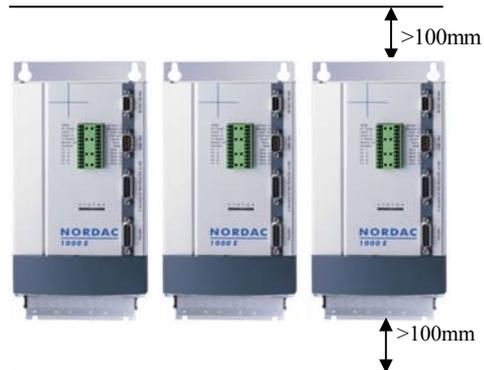
NORDAC SK 1000E servo controllers come in three sizes which reflect the level and range of their performance. To prevent overheating of the devices sufficient ventilation will be necessary. A clearance of > 100mm should by all means be ensured both above and below the servo controllers and the walls of the switch cabinet.

This extra room may be used to accommodate electrical components (such as cable ducts, contactors, etc.). Between any such component and the servo controller a minimum distance must however be ensured which should amount to at least 2/3 of the component's height (example: height of cable duct is 60mm -> $\frac{2}{3} * 60\text{mm} = 40\text{mm}$ would be the clearance to be ensured).

On the other hand if several servo controllers are installed side by side, no spacing will be required. They may indeed be installed one right beside the other. The mounting position is always vertical.



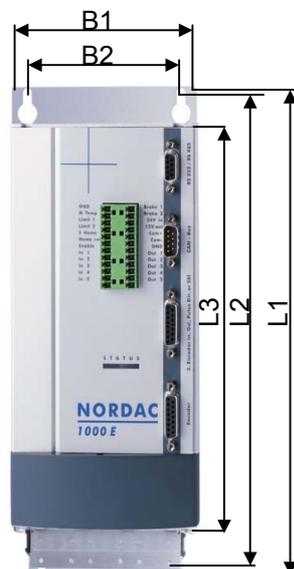
The hot air must be carried off!



2.2 Dimensions

| Frame size | Type name | L1 | B1 | Unit depth T | Detail: attachment | | | Weight approx. |
|-------------------------------|--|-----|-----|----------------------|--------------------|-----|-----|----------------|
| | | | | | L2 | B2 | L3 | |
| 1 | SK 1000E-101-340-A to SK 1000E-301-340-A | 281 | 121 | 217 | 267 | 100 | 222 | 4 kg |
| 2 | SK 1000E-401-340-A to SK 1000E-501-340-A | 331 | 121 | 217 | 310 | 100 | 272 | 5 kg |
| 3 | SK 1000E-801-340-A to SK 1000E-102-340-A | 381 | 163 | 250 | 367 | 140 | 344 | 10 kg |
| Unit depth without front plug | | | | All dimensions in mm | | | | |

B = width
L = length
T = depth



2.3 Wiring instructions

The industrial applications for which servo controllers are designed are characterized by a high level of electromagnetic interference. Usually if they are installed in a workmanlike manner this will be sufficient to ensure safe and troublefree operation. In case that limit values more rigid than those indicated in the EMC rules must be met, the instructions given below should be useful.

- (1) It is extremely important that all devices in the cabinet are effectively earthed. For this purpose the earth conductors should be short with a large cross section and be connected to a common earth connection point or earth bus bar. Any control device linked with the servo controller (e.g. an automation device) must absolutely be connected to the same earth connection point as the servo controller itself. Again the conductor used should be short and have a large cross-sectional area. In view of the low impedance of flat conductors (such as metal bows) at high frequencies, they should be preferred to any other type.

Both the PE of the mains supply cable of the servo controller and the PE conductor of the motor controlled by it should be connected as directly as possible to the earth connection point which is connected to the heat sink. By providing a central earth bus bar in the switch cabinet to which all PE conductors are jointly connected troublefree operation is normally ensured (see also the section on mains and motor connections and the EMC section).

- (2) Use shielded cables for control circuits if possible. Terminate the cable ends carefully and see to it that the shield will cover as much of the wiring as possible with no great lengths of it remaining bare.
The shield of analogue setpoint cables should be connected to earth at one – the servo-controller's end - only.
- (3) The control lines should be laid at a certain distance to the load lines if possible, for instance by using separate cable ducts etc. Whenever there are line crossings, try to arrange a 90° angle between one line and the other.
- (4) Take appropriate measures to ensure that no interference will be emitted by the contactors in the cabinets. Alternate voltage contactors should be included in an RC circuit while direct current contactors should be provided with freewheeling diodes, **with the interference suppression components being fixed to the contactor coils**. The same effect can be achieved if varistors for overvoltage limitation are used. Especially if the contactors are controlled by the relays in the servo controller, noise suppression is indispensable.
- (5) Be sure to use shielded or armoured cables for the motor and brake resistor load connections. Use the earth clamps delivered with the unit to connect these cables directly to the shield supporting angle on the servo controller. A large contact surface should be ensured.
- (6) If the drive is to work in an environment sensitive to electromagnetic interference, we recommend to use radio interference suppression filters to reduce the noise emitted by the servo controller and the cabling. Fit the filter as closely as possible to the servo controller and ensure very thorough earthing.
To further increase electromagnetic compatibility, the servo controller with the line filter should be installed inside an *interference-proof housing*, and the *wiring* should *meet EMC standards* as well.

Installation of the servo controllers is to be carried out in accordance with the safety instructions in every respect and without exception!



Important

Control lines, supply cables, and motor leads must be laid separately. They should never be laid in the same conduit/installation duct together.
The test equipment for high-voltage insulations must not be used for cables which are connected to the servo controller.

2.4 Mains and motor connections

| | |
|---|---|
|  | <p>WARNING</p> <hr/> <p>THESE DEVICES MUST BE EARTHED.</p> <p>For the device to work safely and reliably it must have been installed and put into operation by qualified personnel in a workmanlike manner, with all of the instructions mentioned in the present Operating Manual being followed as specified.</p> <p>It is of special importance that the regulations applicable either generally or locally to the mounting and safety aspects of work on power installations (such as the VDE rules), and the regulations concerning the professional use of tools and the use of personal protection equipment be strictly observed.</p> <p>The mains input and the motor connecting terminals may be dangerously live even after the servo controller has been switched off. Always use insulated screwdrivers when you are working on those terminals!</p> <p>Make sure that the input voltage source has been disconnected before you connect the device to any other unit or change any existing connections.</p> <p>Make sure that both the servo controller and the motor are rated to match the connecting voltage.</p> |
|---|---|

The mains, motor, and brake resistor terminals are located underneath the device. When the plastic cover is removed, these terminals will be accessible from the front. Before the supply voltage is switched on, all covers must be fitted back again!

Usually the supply, motor, and brake resistor lines are connected first as the terminals involved are located on the lower p.c. board. The cables should be fed through the slot-shaped opening in the lower grille of the enclosure.

The wiring will be safe and correct if you follow the instructions given below:

1. Make sure that the voltage source is supplying the right voltage and is rated for the required current (refer to the Technical Data section)! Make sure, too, that suitable power switches capable of dealing with the specified current range are provided between voltage source and servo controller!
2. Connect the supply voltage directly to the L₁ - L₂ - L₃ power terminals and to the earth (PE) terminal! For the cross sections of the respective wires see the Technical Data section!
3. Use a four-wire shielded cable to connect the motor. The cable is connected to the U - V - W motor terminals and to PE. **We strongly advise to use the motor cables NORD manufactures specially for this purpose.**
4. Connect a substantial section of the cable shield to the shield supporting angle using the enclosed clamp. The clamp will also ease the pull on the cable.

Please note: For the specified level of radio interference suppression to be ensured it is imperative to use cables with a shield.
5. The **length** of the motor cable must not exceed a **total of 20m**.
6. In view of the fact that the capacitor provided in the direct-current link will charge automatically, the switching cycle, that is the time between switching the power off and then on again, must be set higher than **1 minute**. In other words, after the device has been switched off, wait 1 minute at the very least before you switch it on again!
7. If you install a brake resistor which is an optional component, use a shielded cable as well for connection. If you select the NORD resistors for underside installation, no shielding will be required as the lines are very short.

The terminals for connection of U/V/W/PE are labelled accordingly.

Sizes 1 and 2:

The connection terminals allow for a cable cross-section of **2.5mm²** max.

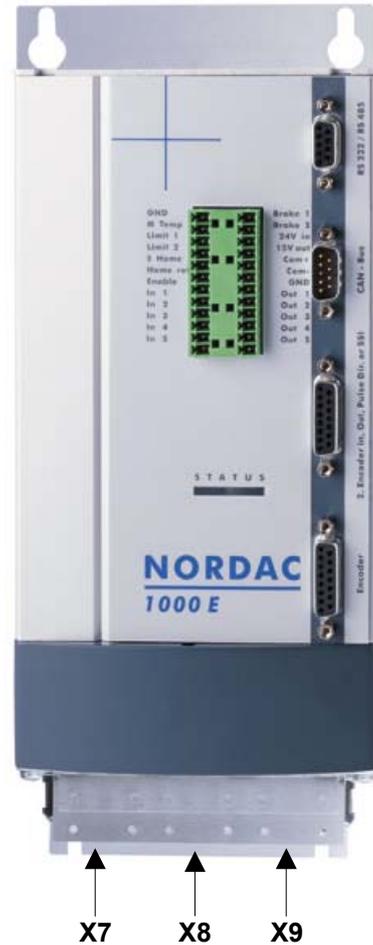
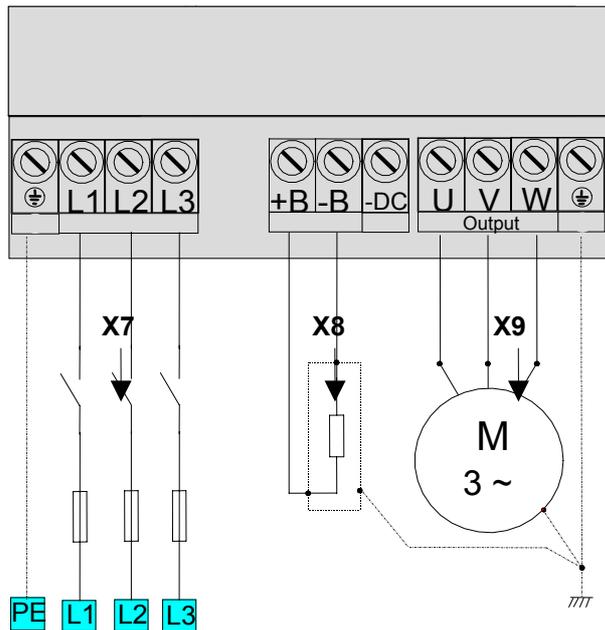
Sometimes, if the wires are provided with a certain type of end sleeves, the maximum cross-sectional area available may be reduced to 1.5mm².

The maximum external diameter of the power cable must not exceed 10.5mm, because if it does, it will be impossible to fix the shield and pull-relief clamp delivered with the unit.

Size 3:

The connection terminals allow for a cable cross-section of **4mm²** max. Sometimes, if the wires are provided with a certain type of end sleeves, the maximum cross-sectional area available may be reduced to 2.5mm².

The maximum external diameter of the power cable must not exceed 15.5mm, because otherwise it will be impossible to fix the shield and pull-relief clamp delivered with the unit.



Optional brake resistor
(cf. Accessories)

Power supply 3 ~ 380V – 460V

Important: Please contact the manufacturer if there is a special power supply system i.g. an IT-system!

2.4.1 Main circuit breakers

Mains circuit breakers have to be taken as follows, it dependence of the operation:
(see Table 4.1 for the respective results).

As acceleration drive (accelerate permanent and brakes with peak current)

>-servo: Peak current > 3 Hz

As duration drive (accelerate one-time and only slow occasional revolutions per minute adjustment)

>-servo: Rated current

2.5 Control terminals

2.5.1 24V I/O

- Type of connection terminals: - screw-type terminal strips are provided as standard
- Maxim. connection cross section: - 1mm²
- Cable: - to be laid and shielded **separately** from power and motor lines
- Control voltages: - for inputs = 15V to 30V, 10mA min. (0... 7V low, 8... 30V high)
- digital outputs up to 25mA (short-circuit-proof)
 - 15V if the power is supplied by the servo controller via an internal circuit,
 - 24V if an external power supply unit is used
 - analogue input $\pm 10V$, 5mA max., as an analogue setpoint

Please keep in mind that the turn-off delay of the servo controller outputs will vary according to the input resistance of the control unit you are using! The same is true of the servo controller inputs. To ensure optimal switching behaviour, machine control will have to supply a driving power of 10mA minimum.



The control voltages are related to a common reference potential (GND)!

If the 15-volt supply output of the servo controller is used to feed power to its outputs, a bridge connection should be provided between the 15-volt output terminal and the 24-volt input terminal of the servo controller. With this arrangement the 15-volt power generated by an internal servo controller circuit is made available to the internal input/output logic of the device. In that case no external power supply unit will be required. Moreover an additional 150mA max. may be taken from the 15-volt output to be used for purposes which do not concern the servo controller itself. This 15-volt output is uncontrolled and is not short-circuit-proof.

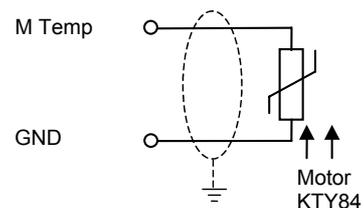
2.5.2 Connection terminals (X5 on the left)

(See also the photo of the front panel)

| Terminal | Function |
|----------|----------------------------------|
| GND | joint (filtered) earth |
| M Temp | motor temperature sensor (KTY84) |

A **motor temperature sensor** (e.g. KFY84) may be connected to the servo controller to prevent excessive heating of the motor.

If no temperature sensor is used, a bridge connection should be provided between the controller input intended for the purpose and GND so as not to produce a disconnection for fault.



| | |
|----------------|--|
| Limits 1 and 2 | Limit switch |
| Home ref | Input of reference switch |
| Enable | When the enable signal is removed, the final stage is shut down. If the drive is operated with a motor brake, a quick stop is executed first. Caution – the motor terminals of the servo controller will still be carrying mains potential though! |
| 6x In | Inputs programmable by the user as required with the assistance of NORD SERV, can also be sampled via the internal PLC. |

2.5.3 Connection terminals (X6 on the right)

(as shown in the photo of the front panel)

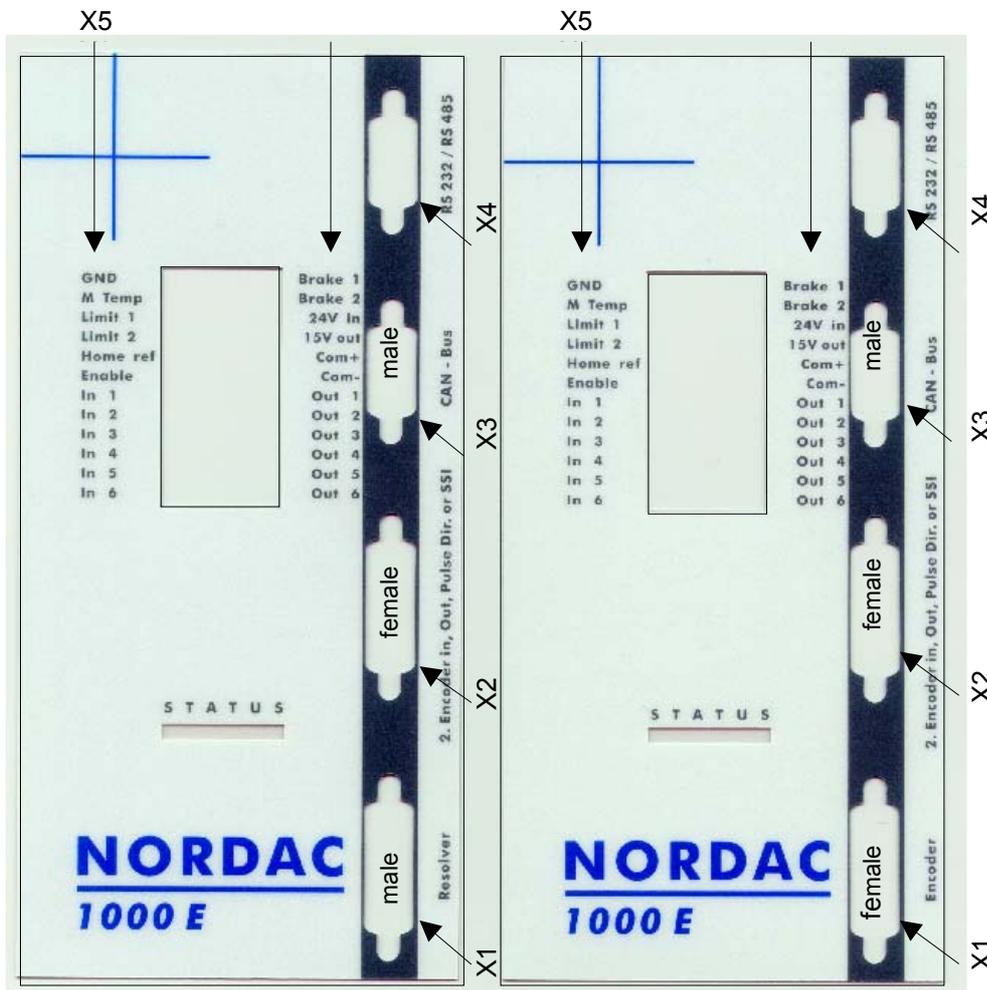
| Terminal | Function |
|---------------------|--|
| Brake 1/ Brake 2 | Monopolar floating relay contact for the motor holding brake Relay limit values: 30V / 4A (do not use the 15-volt output of the servo controller to control a motor brake) |
| 24V In | Input for 24V / 300mA, with holding brake 3A the signals are smoothed, input from the external power supply unit |
| 15V Out | When no external power supply unit is involved, this power will be available for use by the servo controller's own I/O circuits. Please note: there is no short protection! |
| Com+ Com- | Differential input for a +/-10V analogue control voltage |
| 6 Out | Outputs which can be programmed by the user as required with the assistance of NORD SERV, standard functions such as "Position OK", "Enable", or can be activated via the PLC |

2.5.4 Front panel

The figure below shows the front panels. The terminals are identified on the front covers in clear text. The two front panel designs shown differ with regard to the encoder input only. Customers should check whether the type they are ordering is indeed the one they want. The panel cannot be converted afterwards.

Resolver-type controller:

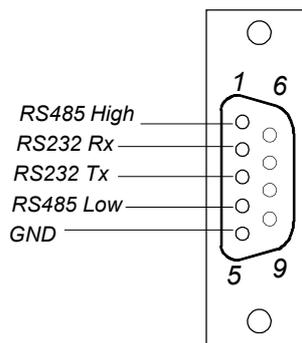
Encoder-type controller:



2.5.5 RS 232 and RS 485 (X4)

With an RS 232 interface a NORDAC SK 1000E servo controller can conveniently be connected to a PC which has got a serial interface and on which the special NORD SERV parameterization and operating software developed by NORD has been installed. This software is included in the scope of delivery of each new servo controller. Via these two interfaces the servo controller can be controlled and parameterized, and a performance test can be executed. When all of the parameters have been set, the data record can be stored as a file both in the PC and in the servo controller.

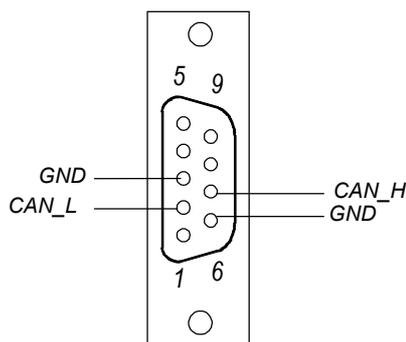
The RS485 interface enables up to 16 servo controllers to be connected in parallel if a converter is used which is also available from NORD on request. NORD also proposes RS485 cables which are specifically produced for this connection configuration (see Accessories). Operation of several servo controllers via the RS485 bus presupposes the same baud rate being used by all of the devices. Besides a unique address must have been assigned to each unit involved in the circuit. Moreover the terminating resistor integrated in the servo controller should be connected into the circuit at the end of the bus (cf. configuration of bus addresses via the fourfold DIP switch described in paragraph 2.5.6)



RS232 and RS485 pin assignment on a 9-pole SUB-D female connector with a UMC-/inch-based screw thread:

2.5.6 CAN bus (X3)

The CAN bus interface is compatible with the ISO 11898 standard. The pin assignment of the SUB-D connector is compatible with the CANopen standard.



Pin assignment of the 9-pole SUB-D male connector with UMC-/inch-based screw thread

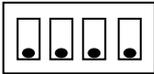
It will be a good idea to use an external CAN bus nodal connector with 2 screw-type terminal connections each (cf. Accessories section).

The CAN bus is electrically isolated from power supply and coupled with the earth connection provided at the terminals.

The servo controller's DIP switches allow for selecting up to 16 different addresses. The addresses will **not** be read in **until** the voltage supply on the servo controller is switched on. However the DIP switches do not only enable the selection of addresses prior to starting operation, but also the setting or activation of the terminating resistors which are integrated in the servo controllers. These switches are located under the snapped-on plastic cover on the front of the servo controller. Use the quadruple DIP switch (S1) to preset the addresses and the twin DIP switch (S2) to enable or disable the terminating resistor.

S1

S2



Arrangement of the DIP switches on the SERVO CONTROLLER, with all of the switches in "OFF" position as standard

S1

| Switch 1 | Switch 2 | Switch 3 | Switch 4 | RS 485 address | CAN node address |
|----------|----------|----------|----------|----------------|------------------|
| OFF | OFF | OFF | OFF | 0 | 1 |
| ON | OFF | OFF | OFF | 1 | 2 |
| OFF | ON | OFF | OFF | 2 | 3 |
| ON | ON | OFF | OFF | 3 | 4 |
| OFF | OFF | ON | OFF | 4 | 5 |
| ON | OFF | ON | OFF | 5 | 6 |
| OFF | ON | ON | OFF | 6 | 7 |
| ON | ON | ON | OFF | 7 | 8 |
| OFF | OFF | OFF | ON | 8 | 9 |
| ON | OFF | OFF | ON | 9 | 10 |
| OFF | ON | OFF | ON | 10 | 11 |
| ON | ON | OFF | ON | 11 | 12 |
| OFF | OFF | ON | ON | 12 | 13 |
| ON | OFF | ON | ON | 13 | 14 |
| OFF | ON | ON | ON | 14 | 15 |
| ON | ON | ON | ON | 15 | 16 |

How to set the address for the bus configuration via the quadruple DIP switch

Addresses assigned as CAN nodes will be increased by 1 in an internal servo controller circuit, in other words when 0 is set as an address via the DIP switch, the servo controller's actual CAN node address will be "1".

The baud rate can be set to 10Kbaud, 20Kbaud, 50Kbaud, 125Kbaud, 250Kbaud, 500Kbaud and even to 1Mbaud. A 500Kbaud rate is normally used. The 1Mbaud rate can be set in a special controller type which is available as an option. The settings are made via the NORD SERV operating software which is supplied with the unit.

S2

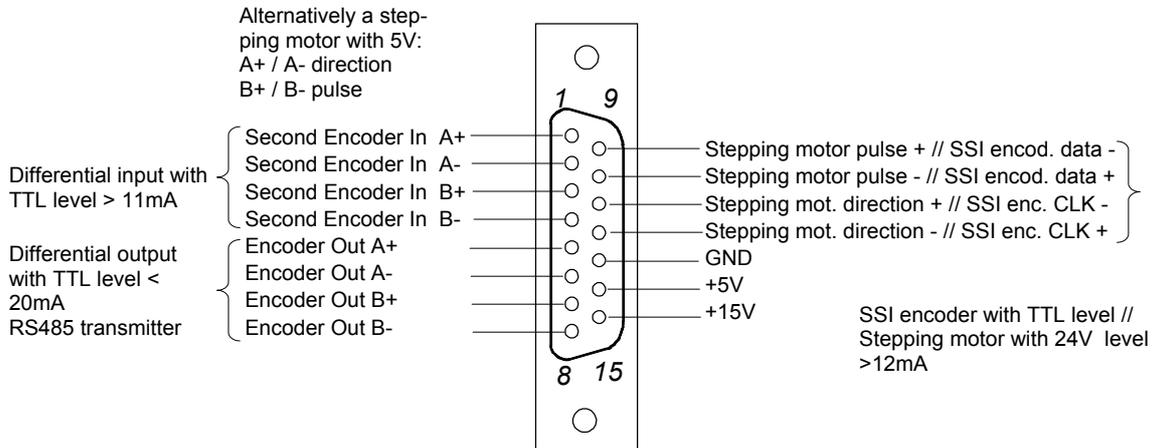
| Switch 1 | Switch 2 | Function |
|----------|----------|---|
| ON | --- | Terminating resistor for the RS485 bus is switched on to provide 120Ω |
| --- | ON | Terminating resistor for the CAN bus is switched on to provide 120Ω |

Working of the double DIP switch

2.5.7 Second encoder in, out, pulse dir. / SSI (X2)

Pin assignment 15-pole female SUB-D with UMC-/ inch-based thread

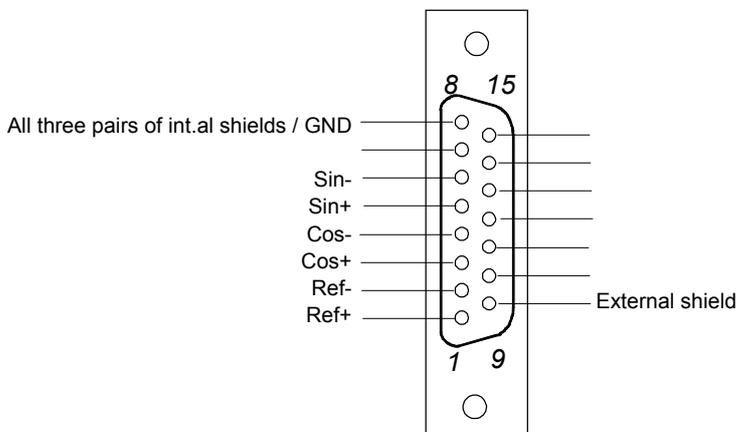
Depending on the controller type, different signal inputs or outputs are available at pins 9 to 12. This would be differential inputs with the "pulse and direction" operating mode (absolute value encoder) or one differential input for SSI data communication and one differential output for SSI clock pulse operation (SSI -> synchronous serial interface). The NORD servo controller works only with SSI absolute value encoders 10 to 30V, 13 bits for single turn and 24 bit for multi turn sensors in Gray code.



2.5.8 Resolver- or encoder-type design (X1)

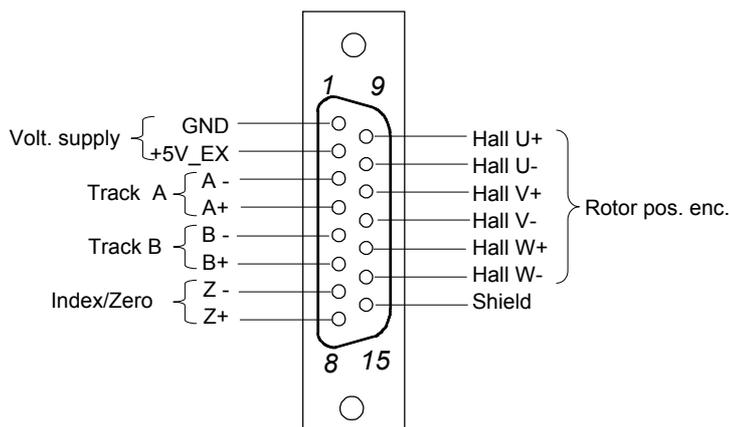
Customers should specify the type they prefer in their order. The servo controller is equipped with the respective feedback system in the course of production. This system cannot be exchanged afterwards.

Pin assignment of 15-pole resolver male SUB-D connector with UMC-/ inch-based thread



or, alternatively,

5-volt TTL encoder with Hall or commutation tracks respectively, pin assignment of 15-pole female SUB-D connector with mit UMC-/ inch-based thread:



2.6 Basic settings

Configuration of the controller implies that a data record with the data of the motor to be controlled must be loaded into its memory. This function is ensured by the NORD SERV software which is supplied along with the controller.

Initial checks: Check whether all cables, including the limit switch cable, have been connected according to instructions and whether all relevant safety precautions have been taken. Provide the servo controller input with a bridge if no motor temperature sensor is used. Connect the servo controller to mains voltage. Make sure that motor starting up will not be hazardous in any way. Apply the enable signal. Start the motor for instance by increasing the speed in the NORD SERV control window. Check whether the motor is turning in the desired direction.



2.7 System start-up

When the supply voltage is applied to the servo controller it will be ready for operation within a few seconds (green LED). Afterwards it can be adjusted to the requirements of the application – that is parameterization can begin. Before the motor is started for regular operation with the enable signal, the controller must have been put into operation for the first time by personnel qualified for this task.



As the servo controller hasn't got a master power switch, it will be live whenever it is connected to the mains.

When an incremental encoder with Hall encoder commutation is used (rotor position encoder), only about 60 % of the peak torque will be available for the first motor revolution following connection to the mains.

Go on to check the maximum allowable speed of the encoder being used or its limit frequency respectively. The limit frequency of the encoders fitted to NORD standard motors (2048 increments/revolution) is 200kHz (6000rpm) at temperatures up to 85°C. However in the temperature range between 85° and 100° the limit frequency will be reduced to 100kHz (3000rpm) only.

If the incremental encoder connection cables are long, the voltage may drop by a significant amount as a result of the ohmic resistance of the encoder's supply cables. The allowable variation of the operating voltage of the encoders used on NORD motors is $\pm 5\%$ (250mV). When the voltage an encoder of this type is fed decreases below this value ($< 4.75V$ measured at the encoder), the encoder will be working in a range which is not in accordance with its specification, hence reliable operation can no longer be guaranteed. If the standard NORD encoder cables are used, a cable length of 20m is possible. If longer cables are required, the cross sections must be larger, or the encoder must be provided with an external power supply. If these instructions are disregarded, there will be pulse losses resulting in position deviations.

Basically resolver cables are not affected by fluctuations of power supply to any critical degree. Still, with the analogue signals of the resolver being evaluated by the servo controller afterwards, the running accuracy will decrease continuously as the cables are infected by parasitic signals.

The axle may be ready for operation right away if the data record with the application parameters stored in the device adequately matches the set of motor data. If the settings have not been prepared in advance, the axle must be put into operation via the user interface (cf. the next chapter of this manual).

2.8 Error code displayed via a two-colour LED

If a fault has occurred, the two-colour LED on the front panel will flash identifying the error or errors according to a code (the LED may change between red and green, or flash a number of times depending on the error type, leaving gaps between signalling one fault and another). Thus the user is enabled to recognize and possibly eliminate servo controller errors even if the device is not connected to a PC (where the operating program could be used) or linked to a bus.

SK1000E flash codes:

| Index | Flash Code | Description | Cause of error |
|----------------------|------------------|---|---|
| 2000h | LED flashes once | The controller has detected overcurrent and will disconnect the final stage immediately. | <ul style="list-style-type: none"> - Short-circuit in the motor - Ground fault of the motor - Final stage overtemperature |
| 2001h 2002h | flashes twice | As a reaction to overcurrent the controller will disconnect the final stage immediately. | <ul style="list-style-type: none"> - Motor connected and motor parameterized do not agree - Controller settings on the whole inadequate |
| 3100h | flashes 3 times | One or more mains phases were disconnected on the controller. | <ul style="list-style-type: none"> - Emergency stop function was activated - Insufficient fusing of supply voltage - Fault current circuit breakers in circuit - Connection between mains cable and servo defective |
| 3210h | flashes 4 times | The DC link voltage is too high. This fault will result in instant disconnection of the motor. | <ul style="list-style-type: none"> - Failure to connect the brake resistor - The brake resistor is defective |
| 3220h | flashes 5 times | The servo controller DC link voltage is lower than the value allowed. | <ul style="list-style-type: none"> - Input voltage is inappropriate - One phase of the input voltage failing to be supplied |
| 4300h | flashes 6 times | Motor temperature in excess of limit temperature | <ul style="list-style-type: none"> - Motor temperature sensor not connected - Heat cannot be discharged because the motor housing is soiled - Current control settings as provided in motor data records provided by customer are inadequate |
| 5400h | flashes 7 times | Final stage signalling permanent fault | If this error continues to be displayed even after the servo controller has been repeatedly switched on and off, the device is defective. |
| 5441h | flashes 8 times | The input used to enable the servo controller has been fed a "low" signal. | For the servo controller to be switched on via a software command, a high level must have been applied to the enable input. |
| 5442h | flashes 9 times | Limit input 1 has received a "low" signal. | The machine carriage has moved to a position triggering limit switch 1, or the limit input has not been connected or deactivated respectively. |
| 5443h | flashes 10 times | Limit input 2 has received a "low" signal. | The machine carriage has moved to a position triggering switch 2, or the limit input has not been connected or deactivated respectively. |
| 6210h to 6271h | flashes 11 times | Error in the servo controller PLC program | For a detailed description see CAN section 5.3. Errors signalled by servo controller. |
| 6290h | flashes 11 times | An address in the internal PLC program accessed via the 2C01h index is not the one desired | <ul style="list-style-type: none"> - A different PLC program has been installed in the Servo - The addresses in the PLC program have changed as a result of adding or deleting instructions |
| 6291h | flashes 11 times | Home command has been ignored | Motor axle was moving when the home command was activated |
| 6300h | flashes 11 times | An error has occurred while the data record was being downloaded via index 2010 | An attempt was made to load a data record into the controller which belonged to a different type of final stage. |
| 7310h | flashes 12 times | The axle has remained outside the speed deviation error window for a time exceeding the interval set. | <ul style="list-style-type: none"> - Axle may be blocked by an obstacle in the machine or as a result of a gearbox problem, |

| | | | |
|-------|------------------|--|--|
| | | | <ul style="list-style-type: none"> - too low a setting has been selected in the contouring error parameter - shaft encoder was not connected properly (positive feedback) - encoder offset setting is inadequate (positive feedback) |
| 8120h | flashes 13 times | Reaction to a communication breakdown between the live controller and the control device for the complete duration provided for by the setting. | <ul style="list-style-type: none"> - The period allowed for this event is too short. - Connection cable is defective or has dropped off |
| 8130h | flashes 13 times | The CAN driver of the servo controller has switched to the "bus off" state | <ul style="list-style-type: none"> - Wrong cable type, or cable defective or dropped off - Shield of connection cable not connected properly - 120-ohm terminating resistors not connected properly - Devices connected to the bus have different baud rates - There is considerable amount of interference |
| 8410h | flashes 14 times | The speed setpoint value received is higher than the maximum limit defined in the "limit" parameter dialogue box | A change of the encoder has resulted in a different speed constant (NORD SERV menu: "Device/Constants") and hence in different binary values |
| 8611h | flashes 15 times | The contouring error (relating to position deviation) entered in the "Limits" parameterization dialogue was exceeded. | <ul style="list-style-type: none"> - Axle blocked by an obstacle in the machine or a gear box problem - Axle tight due to lack of maintenance (lubrication) - Activated parameter set is wrong or parameter optimization has failed (often the selected gain or input control of the position controller are inadequate) - The contouring error value selected is too low |
| 8710h | flashes 16 times | While electronic adjustment between the speeds of different motors was going on, the slave has approached the master moving out of the defined contouring error window | <ul style="list-style-type: none"> - Slave-controlled axle is blocked by an obstacle in the machine or a gearbox problem - Slave-controlled axle is tight as a result of insufficient lubrication (maintenance) - The parameter set selected for the slave servo controller is wrong, or an inadequate setting has been made while attempting optimization (often unsuitable values are selected for the position controller in the gain or input control parameters) - The electrical connections between the two servo controllers are defective - A wrong setting has been made in the servo controller regarding the monitoring function (gear ratio, sense of rotation to be ensured by slave) |
| 8810h | flashes 17 times | Function allowing to subsequently connect a motor into a circuit at the speed of another motor is active | The maximum speed was exceeded in the torque mode (applies to the winder and dancing roll control as well) |

2.9 With and without special technical control functions

Functions tailored to specific technical requirements will be ensured by software modules available as options which can be added to and activated along with the standard software. Functions provided by these special extension modules include e.g. "electronic gearing", "winder and dancer control", and "flying saw control". Each servo controller must be enabled for operation with any of those modules separately. To check their release status use the "Option / status of technological functions" menu item.

It is possible even to have an extension module enabled by NORD at a later date. For this operation NORD will need to know the device code which you should find in the "Option / status of technological functions" menu item as well. Having ascertained the proper enabling code for the device in question NORD will inform you accordingly. The next step is for you to enter this code into the dialogue box mentioned above. Now your servo controller is enabled and ready for operation, and you may use any of the application-related functions as you please.

3 PC operating software (NORD SERV)

Please note: Detailed information on all dialogues will be available when you click on the relevant help button! That is why in the present document we are providing an overview only.

3.1 Hardware and software requirements

- IBM-PC/AT and compatible devices type 486 or higher
- 16 MB of RAM
- 6 MB of free disc space on the hard disc
- uncommitted serial interface with which to couple the servo controller with a PC on which NORD SERV has been installed (cables as described in the NORD set of cables paragraph)
- mouse or similar system
- resolution to be 800 * 600 minimum, the oscilloscope function will be optimal if the resolution is 1024 * 768 dots
- NORD SERV will run under Windows 95, 98 as well as under Windows NT, Windows ME, Windows2000, and Windows XP

3.2 Installation

The installation assistant will start installation automatically from the enclosed CD. Please select the software components you want to be installed.

3.2.1 How to update the database provided by the manufacturer

Installation of the NORD SERV software includes installation of the NORD database comprising the various motor – controller combinations. However as NORD will continuously be calibrating new motors, the user will of course be provided with options of updating the manufacturer's database in the NORD SERV software whenever he wishes to do so. The latest manufacturer's database can be copied and saved to memory from a floppy disc or a CD, or be downloaded from the internet. Whenever a new manufacturer's database has been established, NORD will provide it in the internet. Likewise with any new drive set NORD will send an updated floppy disc to the customer in addition to the CD containing the operating software. Having installed the NORD SERV operating software from the CD, the user can select the "Database \ Update" pull-down menu item to have the update executed. A Windows dialogue box will open enabling the user to select the directory that contains the new files of the manufacturer's database. Although there are three files actually: "Amplifier.dat", "NordDataBase.dat", and "Motor.dat", it will be sufficient to select any of these and to press the ENTER key afterwards. Following this command the program will install the new database created by the manufacturer (all three files that is) in the NORD SERV working directory where they will be available for instance to be transferred to the servo controller's memory.

Neither the user's own database nor any of the PLC programs in the NORD SERV software will be affected by this updating operation. Whenever a new NORD SERV version is installed by the user in any of his existing directories, the manufacturer's database will be automatically updated in the process as well. Even then the user's own database and PLC programs will not be affected however.

3.3 Functions

NORD SERV is the PC program enabling parameterization, optimization, configuration, and control of the servo controllers produced by the NORD company.

With NORD SERV, up to 16 servo controllers can be addressed at a time via the integrated RS485 interface. Communication will proceed via the PC's serial interface and a RS232/RS485 converter which is available as an extra.

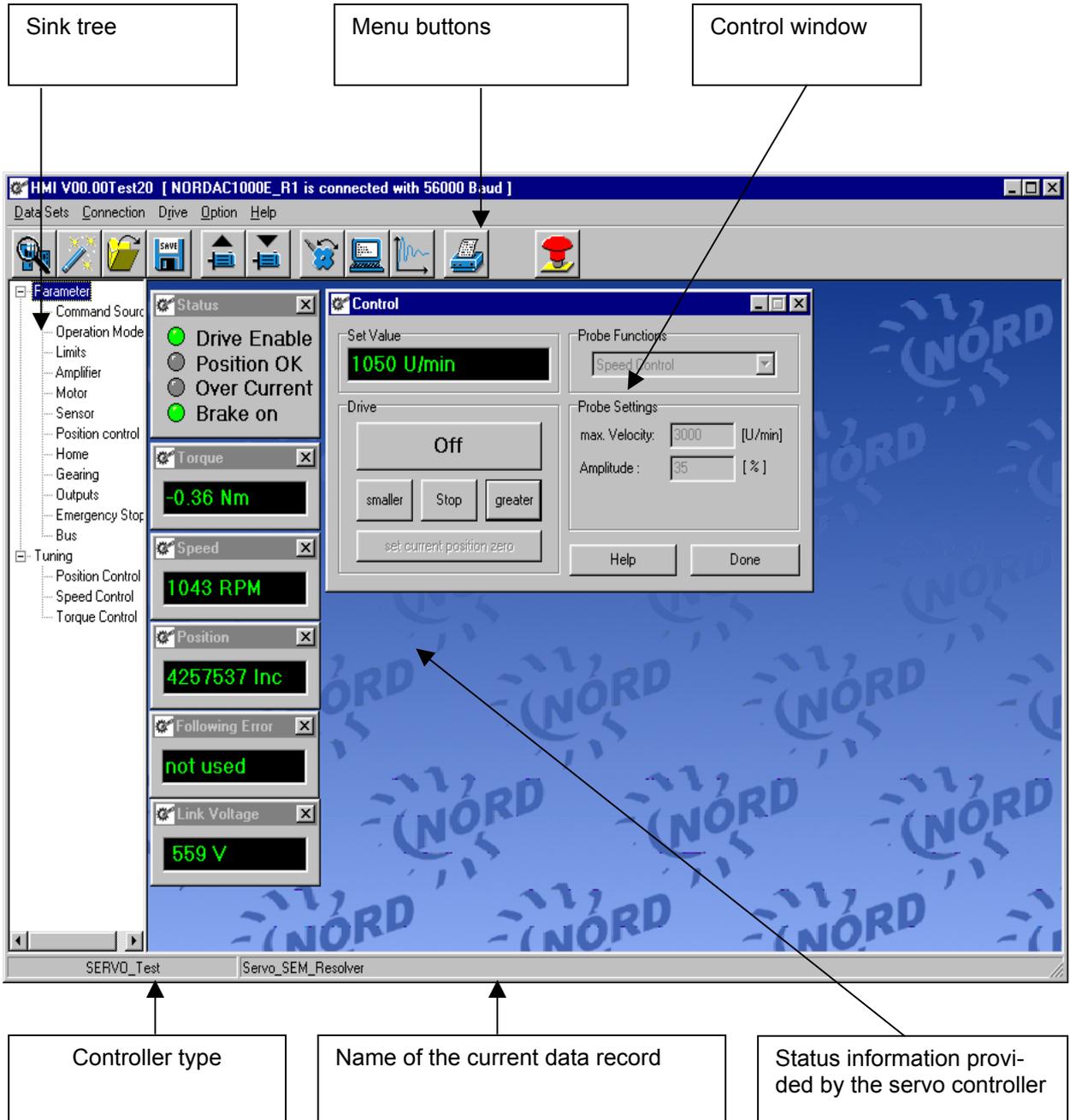
For setting-up or test procedures the servo controllers can be controlled and monitored from the PC. In addition, the behaviour of controlled variables such as currents, speed, position etc. can be registered in the servo controller, loaded into the PC, and then viewed using the NORD SERV oscilloscope function.

With NORD SERV parameter settings can be made, documented, and saved. Moreover all parameter settings can be read out by the servo controller. As soon as contact has been established with the servo controller connected to the PC, NORD SERV will recognize the type (hardware and software version or variety respectively) and display to the user the applicable data records only. Parameter records can also be created or edited off-line, that is without a servo controller being connected.

Programming and testing of the PLC's contained in the servo controller is ensured by NORD SERV as well.

3.4 Principal elements

The figure below shows the operating interface which is presented to the user if a servo controller is linked with a PC via the RS232 interface.



View of NORD SERV interface with the servo controller connected to a PC via RS232

3.5 Parameterization assistant

When the NORD SERV program has been accessed the parameterization assistant appears proposing a series of selection options.

If the program hasn't been started in the language you want (German or English), close the dialogue box and select the desired language under the menu item "*Option/Language*" or "*Optionen/Sprachen*"

respectively. Return to the parameterization assistant using this button : .

Now the assistant will take you from one dialogue to the next until all inputs have been completed :

1. In the first dialogue you will be requested to select either of the PC's serial interfaces for the program to use. Make sure that the interface you have selected is not being used by another active program!

2. Connection with the servo controller is established with the next step. If there are any problems please check the following:

- Does the program use the correct interface?
- Has the serial connection with the servo controller actually been established?
- Is the cable that has been connected the appropriate one?
- Has the servo controller switch for the supply voltage been set to ON?

3. When the connection between the PC and the controller has definitely been made, the dialogue for loading is automatically opened. In it you can select a suitable data record (from the database) from among those stored in the PC's memory. The load dialogue will display only those data records which match the connected servo controller. From the box listing "*Motor options*" (*Motorauswahl*) you may then select the motor about to be used. When you have done so the program will not display any but those motor/servo controller combinations which go together properly.



At this stage take the utmost care because if you click on the wrong motor, the one that will actually be used may be damaged!

4. In the next dialogue box you will be proposed "*Data records defined by the manufacturer*" ("*herstellerdefinierte Datensätze*"). From these you should choose the one which fits your application best. This dialogue box shows so-called reference data records which have been generated by NORD. These data records have been optimized with a view to a particular motor / servo controller combination and for an off-load motor axle. Data records optimized by the customer will be stored in the box called "*user-defined data records*" ("*anwenderdefinierte Datensätze*").

5. When a data record has been selected, a series of dialogues is opened which allow the control parameters to be adjusted to the requirements of the drive project. If you are in doubt regarding one issue or another in any of the dialogues, please avail yourself of the help provided online.

6. When this procedure has been completed the assistant will open the online screen. On the left the principal actual values are displayed along with the servo controller status. Use the "*control*" window ("*Steuern*") to put the driving axle into operation as described in the paragraph "*How to control a drive*" ("*Steuern eines Antriebs*").

The parameter values can be varied any time via the sink tree on the left even after the initial settings have been made.

3.6 How to control a drive

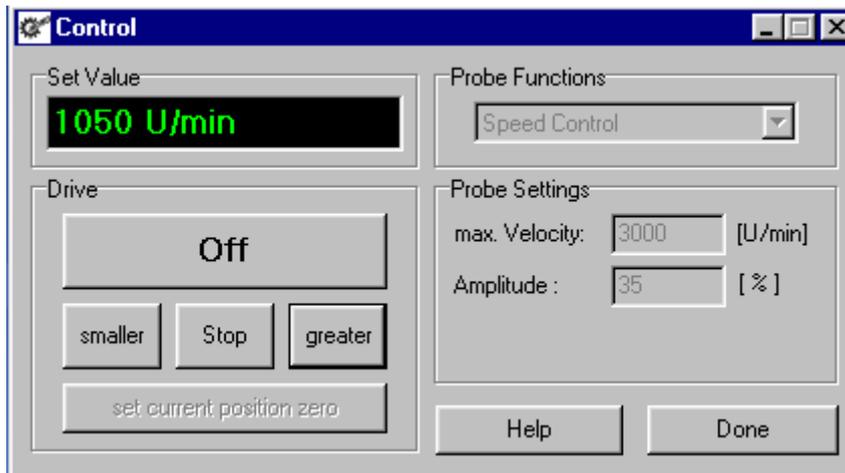
The servo controller can be started up and tested in situ using the operating interface. Click this button



to call the "control" window ("Steuern") where the required options are proposed.

3.6.1 Servo controller ON and OFF

The servo controller is switched on by pushing the "ON" button ("Ein"). When the device is energized the text on the button changes to "OFF" ("Aus"). Accordingly, when the button is pushed again, the controller is switched off.



Control window

3.6.2 How to vary setpoints and transmit them to the servo controller

The setpoints can be varied with the "decrease" ("kleiner") and "increase" ("größer") buttons. Whenever a change is made it will be transmitted to the servo controller immediately and the new setpoint will be shown in the "setpoint" display. The setpoint incrementation is 5% of the maximum value displayed. The maximum value is adopted from the "Limits" dialogue. Setpoints exceeding this maximum value will not be accepted. Small setpoint jumps can be effected by reducing the maximum setpoint manually.

Provided that control is executed in either the torque or the speed mode, the "Stop" button can be used to set the setpoint to zero right away. Pushing the "Stop" button once again ensures that the setpoint is transmitted to the servo controller. This procedure may also be used to generate setpoint jumps which will permit an analysis of a step response by means of the oscilloscope function.

3.6.3 How to set the test and the control mode

The multiple-option "test mode" box allows for the following operating modes to be set in the servo controller while it is de-energized:

- position control
- speed control
- torque control
- speed reversal
- torque reversal

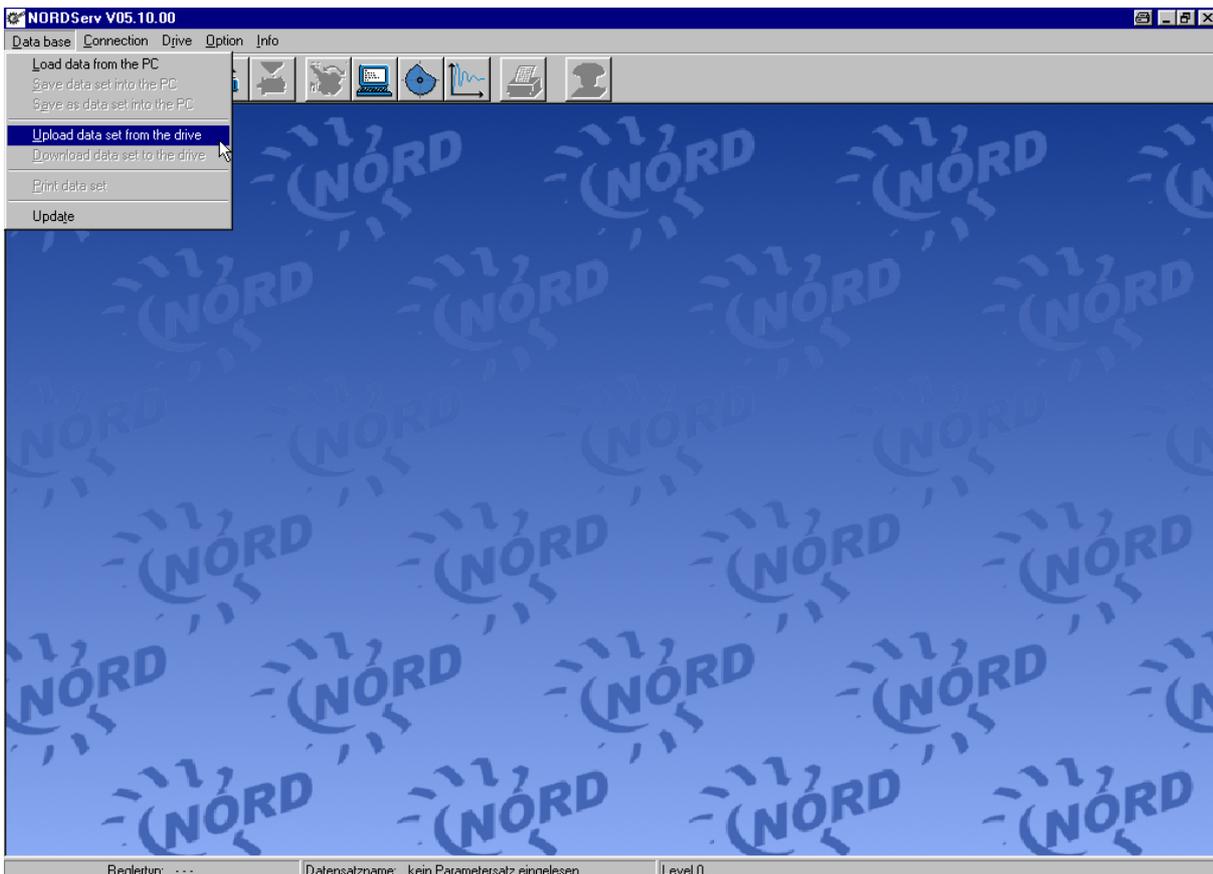
When the position control mode is on, the "Stop" button changes to "Home". With this function a reference point tracking operation can be started. Until this operation is completed the button will be locked down, and no setpoints can be transmitted. Besides, the actual position indicated by the servo controller can be set to zero with the button to which this function is assigned ("current position equal to 0"/"aktuelle Position gleich 0"). Before this function is used the motor must be de-energized however. In the test mode, setting the actual position to zero is a way to avoid reference point tracking. As far as reversal is concerned, the current setpoint is negated when the time entered in "pulse width" ("Pulsbreite") has elapsed.

3.7 Data transfer and long-term storage in NORD SERV

When configuring the servo controller to specific operating requirements with the NORD SERV program, users should be aware that data records and the PLC program are treated separately. Communication with the servo controller is possible via the integrated RS232 / RS485 interface and the CAN interface of the PC.

3.7.1 How to load a data record

In the NORD SERV program the **Database** menu item allows for loading either a new data record or a data record completed at an earlier time. The user may choose between PC (off-line) and controller (on-line) as possible sources, activating either the **Load data record from PC** menu item or the one saying **Load data record from controller**.



With a click on the icon  **Load data record from controller** it is possible to load the active data record into NORD SERV from the connected controller any time, even while the axle is in motion.



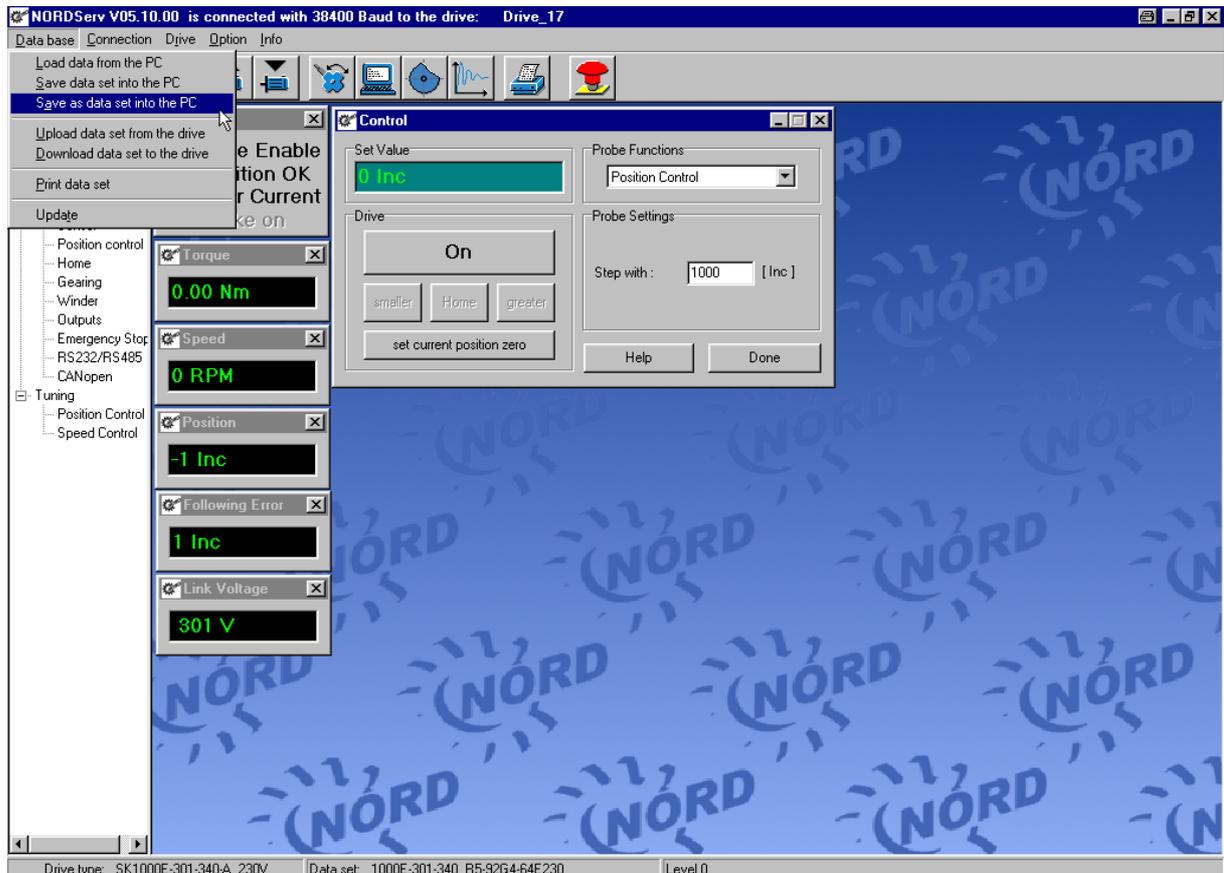
The button  **Load data record from PC** allows for opening any formerly edited data record in NORD SERV that is stored on the PC's hard disk or a floppy disk.

The following information regarding the data record just loaded are displayed in the NORD SERV bottom line:

- servo controller type designation
- name of the currently activated data record
- enabled user level

3.7.2 How to transmit a data record or store it in the PC

After parameter setting has been completed, the edited data record can be stored in the PC using the command options **Save data record in PC** or **Save data record in PC as**, or transmitted to the controller's flash memory with the **Transmit data record to controller** command.



Direct transmission of the currently active data record to the controller can also be initiated by clicking



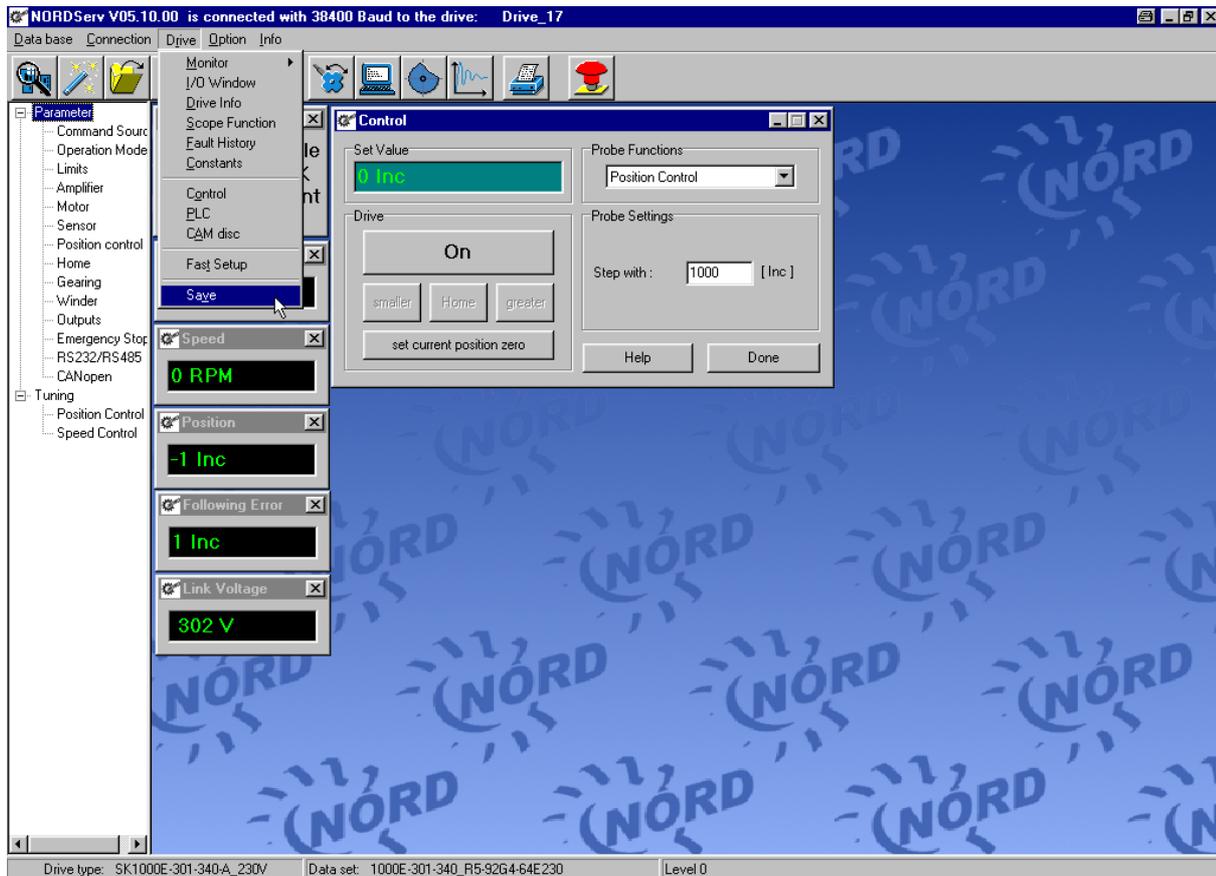
on the **Transmit data record to controller** icon . When operating the **Transmit data record to controller** function users should be aware of the fact that storage of the data record in the controller RAM will be volatile only, in other words that any modification of the data record will be lost as soon as the controller is switched off, i.e. disconnected from the mains. Keep in mind therefore that whenever you have changed parameters and values for instance while optimizing a system or setting it up for operation and transmitted these changes to the controller afterwards, they still need to be saved to ensure that they will in effect be permanently stored in the servo controller.



Use the **Save data record in PC** button to store the data record you have been editing on the PC's hard disk. If you want to store the data record currently active by a different file name, use the **Save data record in PC as** menu item.

3.7.3 How to save the data record in the controller

The **Save** function is available as an option in the **Device** menu item. Using this function ensures that the storage of changes performed on the data record will no longer be volatile (as it is in RAM) but permanent (in ROM).

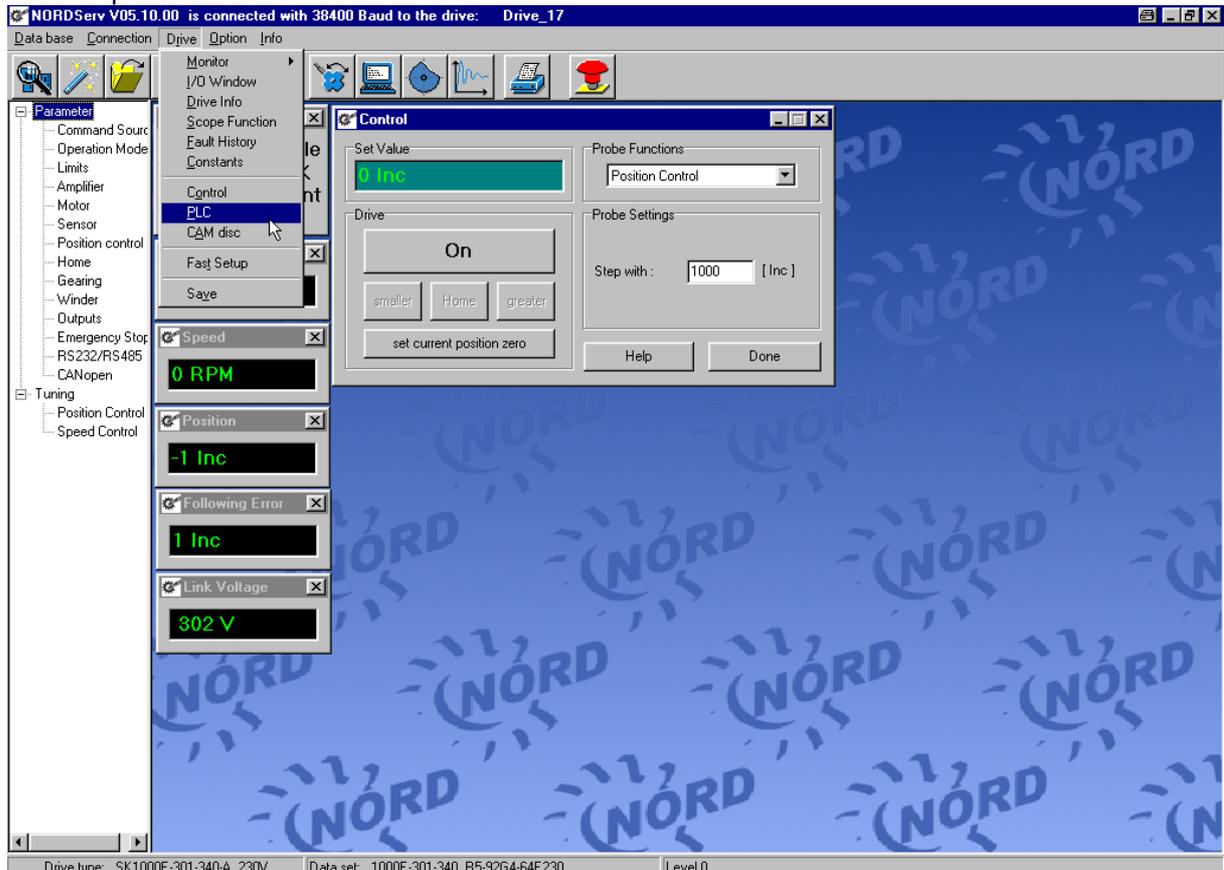


The controller will take a few seconds to execute a saving operation. While this procedure is going on, no communication or input/output signal processing will take place. That is why the motor must be de-energized before saving is started.

3.7.4 PLC programming window



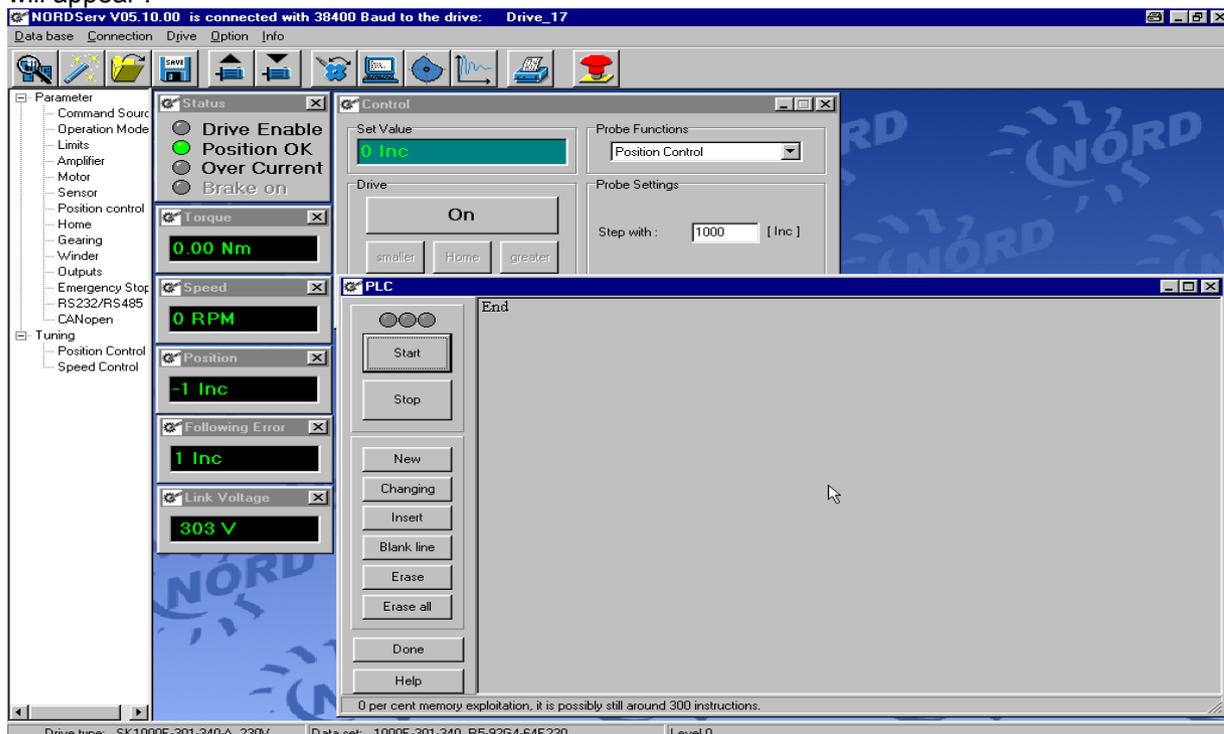
The PLC programming window provided by NORD SERV is either accessed using the icon or opened in the **Device** menu item.



The PLC programming window allows for editing and displaying the PLC program or the program execution respectively.

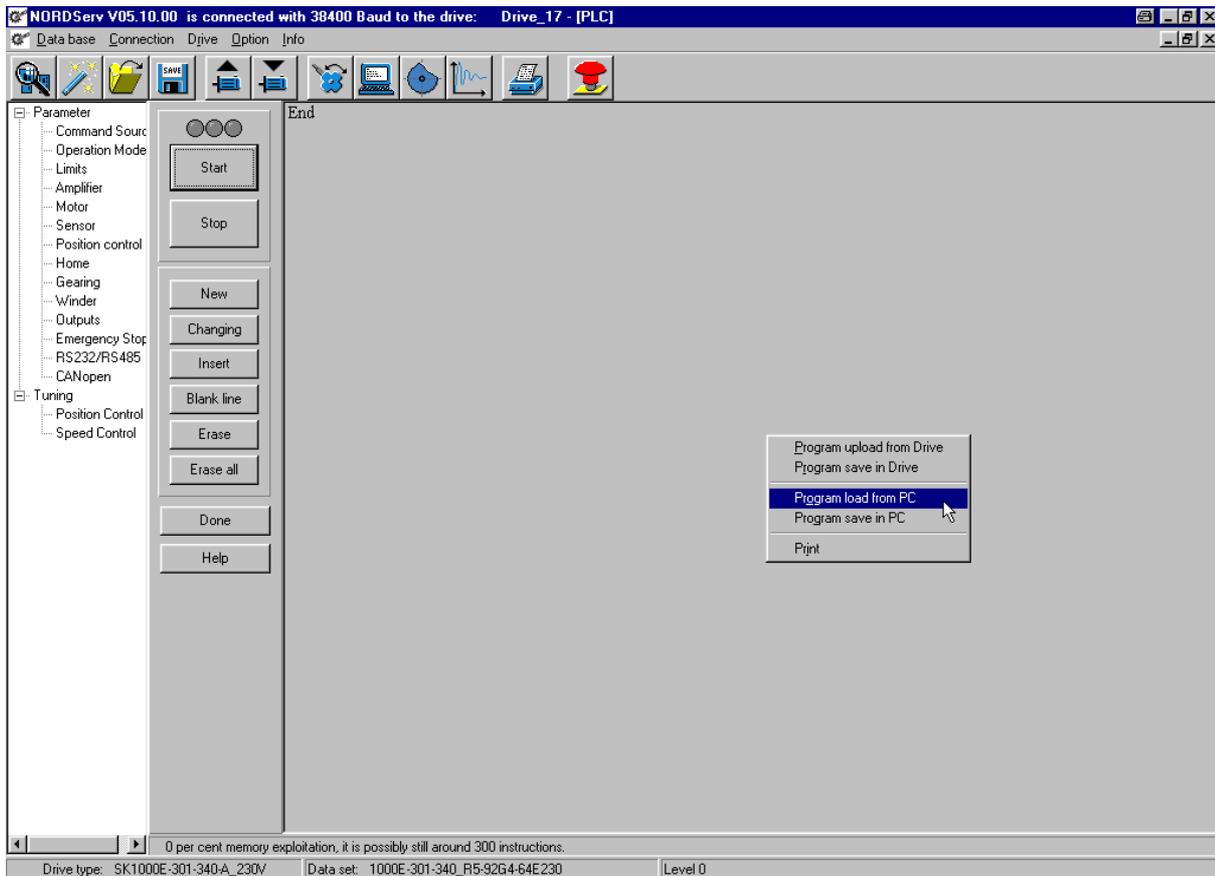


When the icon or the **PLC** menu button is used, the PLC programming window shown below will appear :



3.7.5 How to load an PLC program

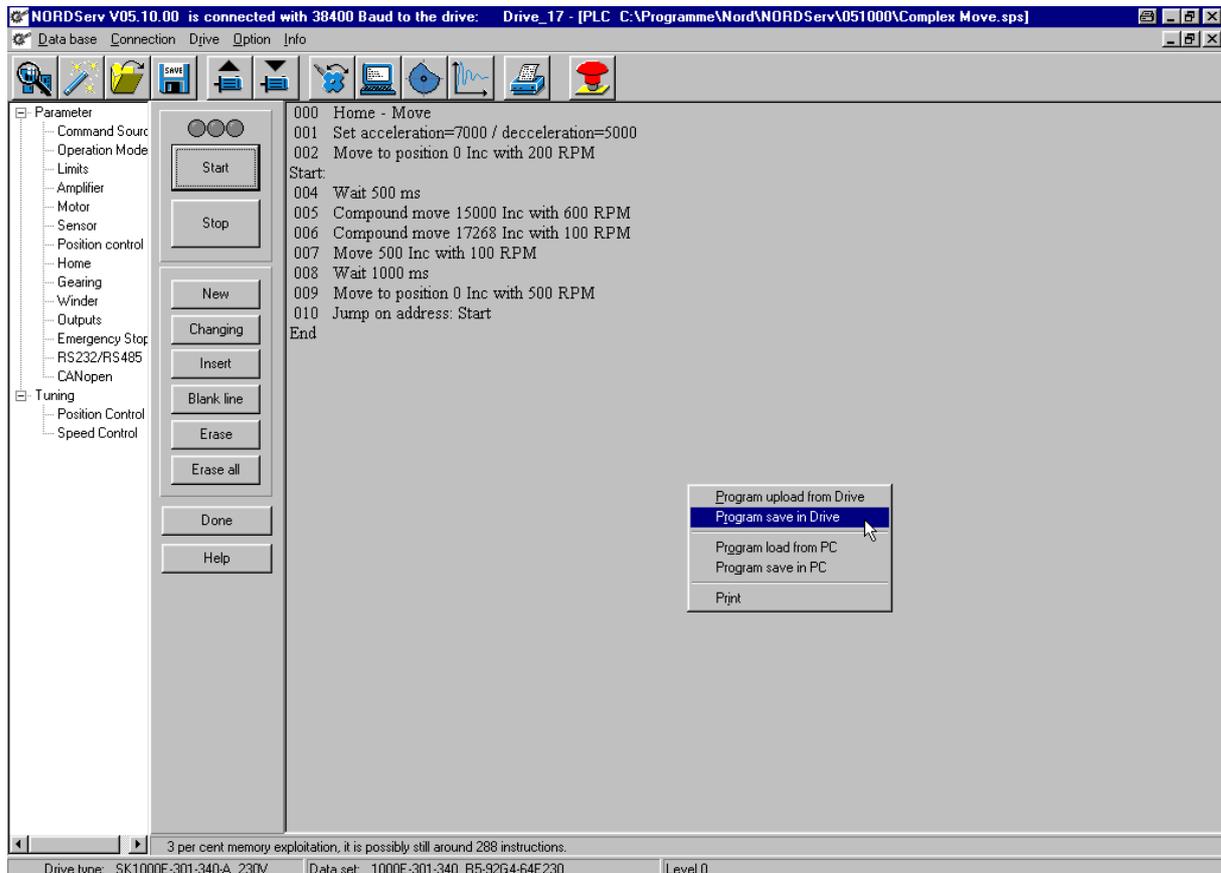
Move the cursor into the PLC window and press the right mouse button to open the window which contains the options enabling you to load an PLC program available in either the PC or the controller. Now activate the appropriate command: **Load program from controller** or **Load program from PC**.



If the PLC program is opened again while parameterization in NORD SERV is still going on, the system will automatically open the PLC program edited last.

3.7.6 How to save an PLC program

When the user has finished creating or changing an PLC program, it still remains to be permanently saved. This is done using the right mouse button again to click either on **Save program in the controller** or on **Save program in the PC**.



To close the PLC window, operate the icon  in the top right-hand corner of the PLC window.

Important note:

Saving a data record does not imply however that the PLC program will be saved along with it automatically.

As PLC program and data record are independent of one another, each needs to be loaded or saved on its own.

4 Technical data

4.1 Electrical data

| Type name: | SK 1000E ... | -101-340-A | -201-340-A | -301-340-A | -401-340-A | -501-340-A | -801-340-A | -102-340-A |
|--|--------------|--|-------------|------------|------------|------------|------------|------------|
| Electric power | [kW] | 1 | 2 | 3 | 4 | 5 | 8 | 10 |
| Frame size | | 1 | | | 2 | | 3 | |
| Supply voltage | | 3 AC 380 - 460 V, -20%/+10%, 47 ... 63 Hz | | | | | | |
| Rated current rms | [A] | 3.6 | 4.8 | 6.3 | 8.4 | 10.8 | 15 | 20 |
| Peak current for 60s rms at standstill | [A] | 5.1 | 6.7 | 8.8 | 11.7 | 15.1 | 21 | 28 |
| Peak current <60s >3 Hz rms | [A] | 7.2 | 9.5 | 12.4 | 16.6 | 21.4 | 30 | 40 |
| Brake resistor | | external installation (cf. 4.3.2) | | | | | | |
| Mains-/ emergency-off switching time | | After a disconnection don't energize the unit for at least 1 minute! | | | | | | |
| Ambient temperature | | 0°C ... +40°C in continuous operation | | | | | | |
| Type of cooling | | Convection | Fan cooling | | | | | |

4.2 Functions

| Function | Specification |
|---|---|
| Feedback resolver or Feedback incremental encoder | Accuracy 10bits, resolution 12 bits, speed range +/-22500 rpm, 2-pole, 7Vrms 5V supply <150mA, speed range 4096 increments = +/-18500 rpm, from 500 upwards any number of increments up to 4294967295 may be used (e.g. 500, 512, 1000, 1024 etc.) Please verify the allowable output frequency of the encoder you are using. Typically it will be around 200kHz. Based on the speed of rotation the max. number of increments allowed will result from the respective output frequency. NORD standard: 2048inc/rev. 85°C 200kHz max. (6000rpm); 100°C 100 kHz max. (3000rpm) |
| Protection ensured against | excessive temperatures of servo controller and motor over- and undervoltage short-circuit fault, ground fault, overload |
| Types of control | Speed profile, torque, speed, and position control with a process sampling time of 50µs |
| Analogue setpoint input | +/- 10 V resolution 12 bits |
| Speed calculation | 16-bit |
| Motor temperature control | KTY84 |
| Control inputs | 6 inputs 10 - 30 V, to be assigned as required, e.g. to the PLC, to a plus and minus limit switch, enable, reference, motor temperature sensing |
| Control outputs | 1 relay 30V AC / DC / 2A respectively; 6 outputs 24 V / 25 mA, short-circuit-proof, to be allocated as required, e.g. to the PLC |
| Interfaces | RS 232 RS 485 CAN bus up to 500 Kbps |
| Controller efficiency | approximately 95% |
| Interface | 5MHz stepping motor interface (cannot be combined with optional SSI on hardware level, in other words software is unable to deal with control of a second incremental encoder at the same time, NORD SERV will allow for switching from one encoder to the other!) Second incremental encoder input 5MHz, <150mA Required to ensure electronic gearing function (software unable to deal with operation of a stepping motor interface at the same time, NORD SERV will allow for switching from one to the other!) |
| Ambient temperature | 0°C ... +40°C for continuous duty |
| Temperature during storage and shipping | -40°C ... +70°C |
| Type of enclosure | IP20 |
| Electrical isolation | Control terminals (digital and analogue inputs) |

4.3 Accessories

| Accessories | Description | Data |
|-----------------------------------|--|---|
| Motor power cable | NORD works standard available on request | --- |
| Cable for resolver-type encoder | | --- |
| Incremental encoder cable | | --- |
| RS 485 communication cable | | --- |
| CAN bus connection cable | | --- |
| RS232 communication cable | | --- |
| Connecting cable electrical shaft | | --- |
| RS232 / RS485 converter | for connection of a PC to the RS 485 bus | Automatic bps rate recognition and read/write change-over |
| Additional external filters | Filter class B | |
| External brake resistors | For uses where energy is recovered in a regenerative circuit | 100W, 300W, 400W, 600W |

4.3.1 Additional line filter, class B

To be on the safe side with regard to an increased standard of radio interference suppression (class B as per EN 55011), it will be a good idea to loop an additional external line filter (option) in the line cable supplying power to the servo controller. Installation of the line filters must proceed in accordance with the instructions on "wiring" and "electromagnetic compatibility" (as mentioned in the relevant sections of this manual).

| Servo controller type | Filter type |
|---------------------------------|-----------------|
| SK1000E-101-340-A to 301-340-A | SK-LF1-460/14-F |
| SK 1000E-401-340-A to 501-340-A | SK-LF1-460/24-F |
| SK 1000E-801-340-A to 102-340-A | SK-LF1-460/45-F |

4.3.2 Braking resistors (optional)

Whenever the motor is decelerated dynamically, electrical energy is fed back to the servo controller. If no appropriate measures were taken, the device would be disconnected for overvoltage in the course of those periods. This will not happen though if an external braking resistor (optional component) is connected which enables the integrated braking chopper to convert the recovered energy into heat. The braking resistor output should be selected according to the respective application requirements. A wide range of braking resistor capacities is available. The brake resistor may be installed underneath the servo or on its side. For the majority of drive configurations the allocation of servo controllers and braking resistors shown in the table below will provide suitable guidance. The resistor rating will have to be based on the mass to be decelerated and on the respective cycle time.

| Servo controller type | Braking resistor | | | | Length | Width | Depth "T" | Cable |
|-----------------------|------------------|------------|--------------|-------------|--------|-------|-----------|--------------|
| | Type | Resistance | Cont. rating | Pulse power | | | | |
| SK1000E- | SK BR1- | ohms | W | KW | | | | Length Mm |
| 101-340-A | 200/100 | 200 | 100 | 1,8 | 281 | 121 | 48 | 0,75 x 200 |
| 201-340-A | 200/300 | 200 | 300 | 3,0 | | | | |
| 301-340-A | 100/400 | 100 | 400 | 3,6 | | | | |
| 401-340-A | 60/600 | 60 | 600 | 6,0 | 331 | 121 | 48 | 0,75 x 200 |
| 501-340-A | 60/600 | 60 | 600 | 6,0 | | | | |

Pulse power depends on application: max. 5%/120s, All dimensions in mm

4.3.3 Cable set

General: Suitable for trailing and oil-resistant, braided copper shield
Cables and plugs licenced according to UL/CSA
Protected against bending, pull relief provisions
Operating temperature up to 65 degrees Celsius
DESINA colours: power cable – orange,
resolver and encoder cables - green,
bus cables: CAN, RS485, RS232, and connection cables - violet

Cable lengths:

Mass-produced cables 3m, 10m, 15m and 20m from stock
Any length of mass-produced cable is available on request

5 Instructions for maintenance and service

NORDAC SK 1000E servo controllers will not require any maintenance at all if they are operated in accordance with instructions.

If the servo controller is operated in a dusty environment, the cooling surfaces should be regularly cleaned with compressed air. If the switch cabinet is provided with air inlet filters, they, too, should be cleaned regularly or replaced.

Servo controllers in need of repair should be sent to the local NORD distributing agency.

Call your local NORD distributing agency, too, if you are in doubt about any matters concerning repair.

The head office is always at your service as well, of course:
Getriebebau NORD GmbH & Co. in Bargteheide, Germany
Phone: 04532 / 401-514 or -518
Fax: 04532 / 401-555

When you send us a servo controller for repair please bear in mind that we are not in a position to assume responsibility for any parts which may still be attached such as line cables, potentiometers, external display units, etc.!

Best remove all parts from the servo controller which are not genuine.

If you want more information in addition to the one provided in the present brief description, consult the detailed manual in either English or German which we are making available on our internet site.
<http://www.nord.com/>

You may also obtain the said manual from your local distributing agency. Just send them a request.